A man riding system in MCL's orient underground mine

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8
CHAPTER

# RESEARCH & DEVELOPMENT

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## Status of Research Projects under S&T Grant of Ministry of Coal

Research and development projects are covered under 4 thematic areas viz. improvement in production, productivity and safety in coal mines, coal beneficiation and utilization, protection of environment and ecology.

The R&D activity in Coal sector is administered through an apex body namely, Standing Scientific Research Committee (SSRC), with Secretary (Coal) as its Chairman. The other members of this apex body include Chairman CIL, CMDs of CMPDI, SCCL and NLCIL, Directors of concerned CSIR laboratories, representatives of Department of S&T, NITI Aayog and educational institutions, amongst others. The main functionof SSRC is to plan, programme, budgeting and oversee the implementations of research projects and seek review the R&D work.

The SSRC is assisted by a Technical sub-committee headed by CMD, CMPDI. The committee deals with research proposals related to coal exploration, mining, mine safety, coal beneficiation & utilisation and also the project proposals on mine environment and reclamation.

CMPDI acts as the Nodal Agency for co-ordination of research activities in the coal sector, which involves identification of 'Thrust Areas' for research activities, identification of agencies which can take up the research work in the identified fields, processing of proposals for Government approval, preparation of budget estimates, disbursement of fund, monitoring the progress of implementation of the projects, etc.

A total of 390 S&T projects were taken up (till 31.12.2016) and 320 S&T projects have been completed (till 31.12.2016).

## PHYSICAL PERFORMANCE

During 2016-17, six projects have been completed. The status of coal S&T projects during 2016-17 is as under:

| | | |
|---|---|---|
| i) | Projects on-going as on 01.04.2016 | 18 |
| ii) | Projects approved by SSRC during 2016-17 | Nil ( 5 projects have been recommended by the Technical Sub-Committee of SSRC for consideration of SSRC) |
| iii) | Projects completed during 2016-17 (till 31.12.2016) | 6 |
| iv) | Projects on-going as on 31.12.2016 | 12 |

## FINANCIAL STATUS

Budget provision vis-à-vis actual fund disbursement of S&T projects during the period is given below:

**(In Crore)**

| 2015-16 | | 2016-17 | | |
|---|---|---|---|---|
| **RE** | **Actual** | **RE** | **Actual (till 31.12.2016)** | **Provisional (01.01.2017 to 31.03.2017)** |
| 18.00 | 17.59 | 11.00 (yet to be approved) | 4.92 | 6.08 |

## Status of Research and Development Projects undertaken by CIL

For in-house R&D work of CIL, an R&D Board headed by Chairman, CIL is empowered to take decisions. CMPDI acts as the nodal agency for processing the proposals for approval, preparation of budget estimates, disbursement of fund, monitoring the progress of implementation in the projects, etc.

In order to enhance R&D base with in CIL, the CIL Board in its meeting held on 24th March 2008 had delegated substantial powers to CIL R&D Board and the Apex Committee of the R&D Board. The Apex Committee is empowered to sanction individual R&D projects up to Rs.5.0 crore value with a limit of Rs. 25.0 crore per annum considering all the projects together and the CIL **R&D Board is empowered to sanction individual R&D project up to Rs. 50.0 crore.**

Since beginning, 78 CIL, R&D projects have been taken up (till 31.12.2016), out of which 61 projects have been completed (till 31.12.2016).

The status of CIL R&D Projects during 2016-17 is as Tfollows:

| Sl. No. | Parameters | Quantity |
|---|---|---|
| 1 | Projects on-going as on 01.04.2016 | 10 |
| 2 | Projects sanctioned during 2016-17 | 5 |
| 3 | Projects completed during 2016-17 (till 31.12.2016) | 2 |
| 4 | Projects on-going as on 31.12.2016 | 13 |

* Considered by R&D Board of CIL

## Following coal S&T projects were completed during 2015-16:

- **Development of tele robotics and remote operation technology for underground coal mines**

  Under the project, tele-robot has been developed and field trial conducted at Khottadih mine of ECL. The developed robot is capable of monitoring environmental parameters viz. percentage of CO2, CH4, O2 and also humidity & temperature. The real time graphical-user-interphase (GUI) based navigational camera is capable of displaying the status of robot and 3D representation of operational environment in the underground mines from sensor data. Long range communication with the robot through multiple wireless routers was also established.

- **Development of Indigenous catalyst through pilot scale studies of Coal-to-Liquid (CTL) conversion technology**

  Design, development, installation and commissioning of a fully integrated Coal-to-Liquid Pilot plant consisting of coal gasification, gas cleaning, shift reaction, CO2 scrubbing, liquefaction and liquid collection have been successfully completed at the CIMFR, Digwadih Campus, Dhanbad.

  The coal from Dabor OCP, Salanpur Area, ECL with ash content of around 33% has been used for syngas production in a fixed bed updraft air blown gasifier (Coal Feed rate Capacity: 50 – 100 kg/h). Four on-stream experimental runs (continuous) of total 857 hours have been conducted and three experimental runs have produced hydrocarbon liquid. Two Cobalt-based catalyst have successfully been tested in the CTL pilot plant for liquefaction reaction and one of them is a potential catalyst for further scale up studies which has produced 47.0 litres of CTL crude per tonne of coal. The CTL crude is diesel equivalent with the calorific value of 10900 kcal/kg.

  However, as advised by Secretary (coal), MoC, an independent evaluation of the experimental data of CTL project by third party is required to be carried out by CIMFR, Digwadih campus, Dhanbad.

- **Enhancing life of de-watering pipes in coal/lignite mines by prevention of erosion-corrosion with nano-crystalline surface Engineering Treatments**

  Under this project, six types of metallic coating and three types of non-metallic (poly-urea coating) were developed for coating on the Fe410 grade substrate for erosion and corrosion resistance. All combination of poly-urea coatings were found to have extremely good corrosion resistance in all environment as well as possess good erosion resistance.

  On comparing the cost-economics of both metallic and

non-metallic coatings for mining application, it was found that the poly-urea coatings were very cheap and economical and the life of the coated pipelines will be approximately 6-10 years. The poly-urea coated pipes were put into service in different mines and periodic evaluation of these pipelines was conducted by NITT and CARD officials. The coating was intact and the performance of the coating was found to be very satisfactory. The coating thickness was uniform throughout the pipeline and no deterioration in the coating was noticed.

- **Blast design and fragmentation control - key to productivity**

Under this project, field trails were carried out at Nigahi OCP, NCL, Kusmunda OCP, SECL, Samleshwari OCP, MCL and Sonepur Bazari OCP, ECL. The effect of blast design parameters on rock fragmentation, distribution pattern and scattering effect were studied for each blast. Fragment size analysis were carried out using WIPFRAG software.

- **Design and development of truck mounted mobile coal sampler for instant coal ash & moisture analyser at site from railway wagon/ truck**

Under this project, in Phase-I, the feasibility of nuclear technique method with dual gamma-ray transmission for analysis of coal for ash and moisture contents was established.

In Phase -II, truck mounted mobile coal sampler has been developed for instant coal ash & moisture analyser at site and field trials were completed successfully at Ramagundam area of SCCL.

- **Optimization of various parameters of lab scale Coal Winnowing System (Phase-II)**

Under this project, various parameters of lab scale 'Coal winnowing system' were optimized for consistency in product yield and ash of various coal samples with size fraction of 100-75 mm, 100-50 mm and 75-50 mm collected from different mines of WCL. Also, ash, moisture and GCV of product & rejects of each sample were determined & segregation of coal products and rejects done based on the Gross Calorific Value (GCV).

**Following major R&D projects were completed during 2015-16:**

- **To find a methodology of safe liquidation in thick seams of Raniganj Coalfield: Design & development and show-casing demonstrative trials at Khottadih Colliery, ECL**

Under this project, a safe methodology was developed for liquidation of thick seams. During the field trial at Khottadih Colliery of ECL, sub-panels B-2A & B-2B of B-2 panel was extracted safely in a low-incubation coal seam. During the depillaring operation, a number of geotechnical instruments were installed to monitor the stress and deformation of the strata and no significant change was observed in stress and deformation at the time of extraction.

Ventilation parameters were also monitored and 'Fire ladder' of coal seam (R-VI) was established. A general guideline was prepared so that a feasible method can be applicable to a spectrum of geo-mining details and related support design formulations.

- **Development of guidelines to predict distance between toe of the shovel-dumper dump and that of dragline dump with consideration of safety and economical design of both shovel-dumper dump and dragline dump**

The project was undertaken in Jayant, Bina, Khadia, Dudhichua, Nigahi & Amlohri OCPs of NCL, Sasti & Ghugus OCPs of WCL, Samaleshwari OCP of MCL, Dhanpuri OCP of SECL, Sonpur Bazari OCP of ECL and Block-II OCP of BCCL. Geo-engineering parameters i.e. cohesion, angle of internal friction and bulk unit weight were determined for both dragline and shovel-dumper dumps. The stipulated Factor of Safety (1.10 to 1.15) for combined dragline and shovel-dumper dump was selected as per international norms, and the site specific Factor of Safety was determined with the above geo-engineering parameters for dragline and shovel-dumper dumps.

The optimum distance between shovel-dumper and dragline dumps has been selected for the position of shovel-dumper dump which gives Factor of Safety equal to or more than the stipulated Factor of Safety. Based on the above, a general guideline has been formulated for use in opencast mines operative with both dragline and shovel-dumper combination.

## Financial status

Budget provision vis-à-vis actual fund disbursements CIL R&D projects during the period are given below:

**(Rs. in crore)**

| 2015-16 | | 2016-17 | | |
|---|---|---|---|---|
| **RE** | **Actual** | **RE** | **Actual (till 31.12.2016)** | **Provisional (01.01.2017 to 31.03.2017)** |
| 14.00 | 4.88 | 50.00 (yet to be approved) | 13.17 | 36.83 |